Modeling Particle Motion or Particle Distributions (Puffs)

To compute air concentrations it is necessary to follow all the particles needed to represent the pollutant distribution in space and time. This can be done explicitly by following the trajectory of each particle, where a random component is added to the mean velocity (from the meteorological model), to define the dispersion of the pollutant cloud. In the horizontal, the computations can be represented by the following equations:

$X(t+\Delta t)=X_{mean}(t+\Delta t)+U'(t+\Delta t)\ \Delta t$,
$U'(t+\Delta t)=R(\Delta t)\ U'(t)+U''\ (\ 1-R(\Delta t)^2\ )^{0.5}$,
$R(\Delta t)=\exp(-\Delta t/T_{Lx})$,
$U''=\sigma_u\ \lambda$,

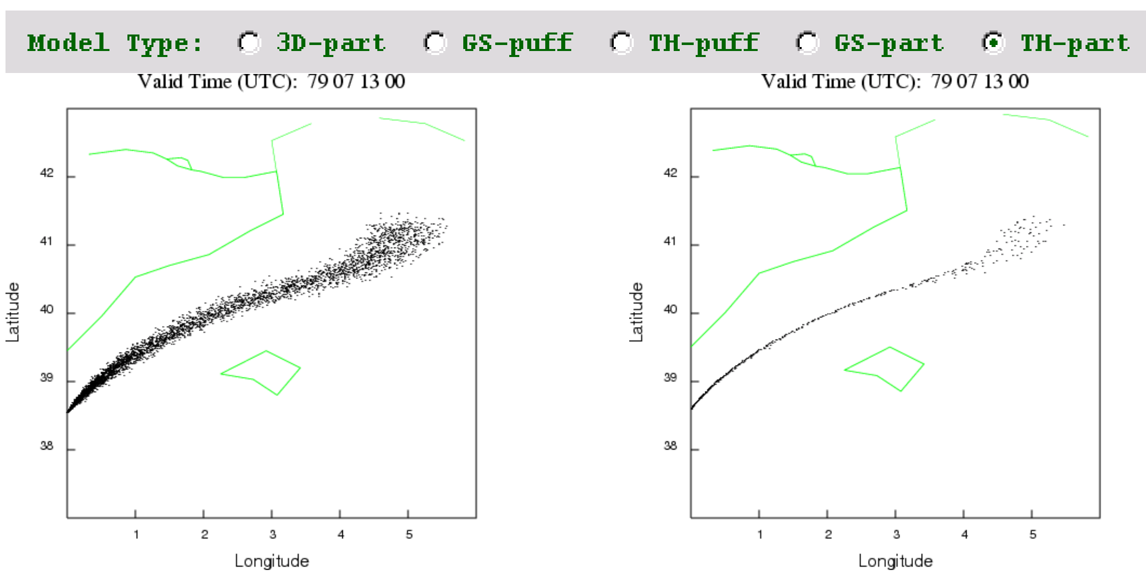
where λ is a random number with 0 mean and σ of 1. The computations can be simplified, if instead of modeling the motion of each particle, we compute the trajectory of the mean particle position and the particle distribution. The standard deviation of the particle distribution could be computed from all the particles,

$$\sigma^2 = \overline{(X_i-X_m)^2}$$

or it can be computed without following individual particles by assuming a distribution shape (puff) and relationship to the local turbulence. Many different formulations can be found in the literature.

$$d\sigma_h/dt = \sqrt{2}\ \sigma_u$$
$$\sigma_u = (K_x / T_L)^{0.5}$$

These computations are set in the "advanced configuration" menu.



3-D Particle distribution　　　Top-Hat Puff center positions

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